

CLAIMS

I/We claim:

- [c1] 1. A method for handling an unmanned aircraft, comprising:
releasably securing a portion of an unmanned aircraft to a storage
apparatus;
removing a lifting surface of the aircraft using a movable portion of the
storage apparatus; and
at least partially enclosing the aircraft in the storage apparatus.
- [c2] 2. The method of claim 1 wherein releasably securing a portion of the
aircraft to the storage apparatus includes pivoting the storage apparatus to
contact and releasably engage a fuselage of the aircraft.
- [c3] 3. The method of claim 1 wherein the storage apparatus is pivotally
mounted to a support platform, and wherein releasably securing the aircraft to the
storage apparatus includes pivoting the storage apparatus from the support
platform to contact a fuselage of the aircraft.
- [c4] 4. The method of claim 1 wherein releasably securing a portion of the
aircraft to the storage apparatus includes pivoting the storage apparatus from a
first position to a second position, the storage apparatus being oriented to contact
and releasably receive the aircraft when in the second position.
- [c5] 5. The method of claim 1 wherein releasably securing a portion of the
aircraft to the storage apparatus includes releasably securing a portion of a
fuselage of the aircraft to a cradle movably carried by a storage apparatus.

[c6] 6. The method of claim 1 wherein releasably securing a portion of the aircraft to the storage apparatus includes releasably securing a portion of the aircraft to a storage container.

[c7] 7. The method of claim 1, further comprising translating and rotating the movable portion of the storage apparatus relative to the lifting surface of the aircraft to align a gripper carried by the movable portion for contact with the lifting surface of the aircraft.

[c8] 8. The method of claim 1, further comprising:
 slidably moving and pivoting a gripper carried by the movable portion of the storage apparatus for contact with the lifting surface of the aircraft;
 and
 pivoting the gripper toward the movable portion after removing the lifting surface of the aircraft.

[c9] 9. The method of claim 1 wherein removing the lifting surface of the aircraft includes:
 releasably attaching the lifting surface to the movable portion of the storage apparatus; and
 moving the movable portion and the lifting surface along a constrained guide path of the storage apparatus.

[c10] 10. The method of claim 1 wherein removing the lifting surface of the aircraft includes:
 contacting and releasably engaging the lifting surface with a gripper carried by the movable portion of the storage apparatus, the gripper being positioned to slidably move along a guide path of the movable portion; and

detaching the lifting surface from the aircraft by slidably moving the gripper along the guide path from a first position with the lifting surface attached to the aircraft to a second position with the lifting surface detached from the aircraft.

[c11] 11. The method of claim 1 wherein removing the lifting surface of the aircraft includes:

translating and rotating the movable portion of the storage apparatus relative to the lifting surface of the aircraft to align a gripper carried by the movable portion with the lifting surface;

contacting and releasably engaging the gripper with the lifting surface; and
detaching the lifting surface from the aircraft by slidably moving the gripper along a guide path of the movable portion from a first position with the lifting surface attached to the aircraft to a second position with the lifting surface detached from the aircraft.

[c12] 12. The method of claim 1, further comprising servicing the aircraft after releasably securing the aircraft to the storage apparatus.

[c13] 13. A method for handling an unmanned aircraft, comprising:
deploying a flexible recovery line from an extendable boom mounted at least proximate to a support platform;
releasably capturing a first lifting surface portion of the aircraft in flight with the flexible recovery line;
while the first lifting surface portion of the aircraft is releasably coupled to the flexible recovery line, securing a second lifting surface portion of the aircraft to the support platform;
releasably securing at least a portion of a fuselage of the aircraft to a storage container;

releasing the aircraft from the flexible recovery line and the support platform;
removing at least one of the lifting surfaces of the aircraft using a movable portion of the storage container; and
at least partially enclosing the aircraft in the storage container.

[c14] 14. The method of claim 13 wherein the aircraft includes a capture device mounted to the lifting surface, and wherein releasably capturing the aircraft in flight includes releasably capturing a portion of the recovery line with the capture device.

[c15] 15. The method of claim 13, further comprising retracting at least a portion of the extendable boom after releasably capturing the aircraft and before releasably securing the second lifting surface portion of the aircraft to the support platform.

[c16] 16. The method of claim 13 wherein at least a portion of the storage container is pivotally mounted to the support platform, and wherein releasably securing the aircraft to the storage container includes pivoting at least a portion of the storage container from the support platform to contact a fuselage of the aircraft.

[c17] 17. The method of claim 13 wherein releasably securing a portion of the aircraft to the storage container includes pivoting at least a portion of the storage container from a first position to a second position, the portion of the storage container being oriented to contact and releasably receive the aircraft when in the second position.

[c18] 18. The method of claim 13 wherein releasably securing at least a portion of the fuselage of the aircraft to the storage container includes releasably

securing a portion of the fuselage of the aircraft to a cradle movably carried by a storage container.

[c19] 19. The method of claim 13, further comprising translating and rotating the movable portion of the storage container relative to at least one lifting surface of the aircraft to align a gripper carried by the movable portion for contact with the lifting surface of the aircraft.

[c20] 20. The method of claim 13, further comprising:
slidably moving and pivoting a gripper carried by the movable portion of the storage container for contact with the lifting surface of the aircraft;
and
pivoting the gripper toward the movable portion after removing the lifting surface of the aircraft.

[c21] 21. The method of claim 13 wherein removing at least one lifting surface of the aircraft includes:
releasably attaching the at least one lifting surface to the movable portion of the storage container; and
moving the movable portion and the at least one lifting surface along a constrained guide path of the storage container.

[c22] 22. The method of claim 13 wherein removing the at least one lifting surface of the aircraft includes:
translating and rotating the movable portion of the storage container relative to the at least one lifting surface of the aircraft to align a gripper carried by the movable portion with the at least one lifting surface;
contacting and releasably engaging the gripper with the at least one lifting surface; and

detaching the at least one lifting surface from the aircraft by slidably moving the gripper along a guide path of the movable portion from a first position with the at least one lifting surface attached to the aircraft to a second position with the at least one lifting surface detached from the aircraft.

[c23] 23. The method of claim 13, further comprising directing an actuator to move the movable portion of the storage container after releasably securing the aircraft to the storage apparatus.

[c24] 24. The method of claim 13, further comprising servicing the aircraft after releasably securing the aircraft to the storage apparatus.

[c25] 25. A method for handling an unmanned aircraft, comprising:
removing at least a portion of a storage apparatus at least partially enclosing an unmanned aircraft to provide access to the aircraft;
attaching a lifting surface to the aircraft using a movable portion of the storage apparatus; and
moving the aircraft from the storage apparatus into position for takeoff.

[c26] 26. The method of claim 25, further comprising moving the fuselage from a first position within the storage apparatus to a second position elevated from the first position before attaching the lifting surface to the aircraft.

[c27] 27. The method of claim 25 wherein moving a movable portion of a storage apparatus includes moving a movable portion of a storage container.

[c28] 28. The method of claim 25, further comprising translating and rotating the movable portion of the storage apparatus relative to the lifting surface of the aircraft to align the lifting surface with the aircraft.

- [c29] 29. The method of claim 25 wherein attaching the lifting surface to the aircraft includes:
- releasably attaching the lifting surface to the movable portion of the storage apparatus; and
- moving the movable portion and the lifting surface along a constrained guide path of the storage apparatus.
- [c30] 30. The method of claim 25 wherein attaching the lifting surface to the aircraft includes:
- contacting and releasably engaging the lifting surface with a gripper carried by the movable portion of the storage apparatus, the gripper being positioned to slidably move along a guide path of the movable portion; and
- attaching the lifting surface to the aircraft by slidably moving the gripper along the guide path from a first position with the lifting surface detached from the aircraft to a second position with the lifting surface attached to the aircraft.
- [c31] 31. The method of claim 25 wherein moving the aircraft into position for takeoff includes moving the aircraft from a cradle movably carried by the storage apparatus to a launch carriage movably carried by a launch guide structure.
- [c32] 32. The method of claim 25, further comprising slidably moving and pivoting a gripper carried by the movable portion of the storage apparatus for contact with the lifting surface of the aircraft, and wherein the gripper is pivoted against the movable portion after removing the lifting surface of the aircraft.
- [c33] 33. The method of claim 25, further comprising directing an actuator to move the movable portion of the storage apparatus.

[c34] 34. The method of claim 25, further comprising servicing the aircraft after providing access to the aircraft and before moving the assembled aircraft into position for takeoff.

[c35] 35. An apparatus for handling unmanned aircraft, comprising:
storage means for at least partially enclosing and releasably storing the aircraft;
fuselage support means for supporting a fuselage of the aircraft, the fuselage support means being carried by the storage means;
gripper means for releasably carrying a lifting surface of the aircraft, the gripper means being movable relative to the fuselage support means; and
guide means for guiding motion of the gripper means, the guide means being carried by the storage means to constrain the motion of the gripper means as the gripper means moves between a first position with the lifting surface attached to the fuselage and second position with the lifting surface detached from the fuselage.

[c36] 36. The apparatus of claim 35 wherein the storage means includes a storage apparatus having at least one movable portion, the movable portion carrying the gripper means.

[c37] 37. The apparatus of claim 35 wherein the fuselage support means includes a carriage movably carried by the storage means and positioned to releasably secure at least a portion of the fuselage of the aircraft.

[c38] 38. The apparatus of claim 35 wherein the gripper means is slidably received in the guide means.

- [c39] 39. An apparatus for handling an unmanned aircraft, comprising:
a storage apparatus;
an aircraft support carried by the storage apparatus and configured to
support at least a portion of an unmanned aircraft; and
a movable device carried by the storage apparatus and configured to carry
a lifting surface of an unmanned aircraft, the movable device being
movable relative to the aircraft support in a constrained manner
along a guide path.
- [c40] 40. The apparatus of claim 39, further comprising a support platform,
and wherein the storage apparatus is pivotably carried by the support platform
and is pivotable between a first orientation and a second orientation, the storage
apparatus being positioned to contact the aircraft when in the second orientation.
- [c41] 41. The apparatus of claim 39 wherein the aircraft support includes a
fuselage support member carried by the storage apparatus, the fuselage support
member being movable from a first position for storage to a second position for
launch.
- [c42] 42. The apparatus of claim 39 wherein the aircraft support includes a
cradle positioned to releasably secure at least a portion of a fuselage of the
aircraft.
- [c43] 43. The apparatus of claim 39 wherein the movable device translates
and rotates relative to the lifting surface of the aircraft to releasably engage the
lifting surface, and wherein the movable device is positioned to slidably move
along the guide path from a first position with the lifting surface attached to the
aircraft to a second position with the lifting surface detached from the aircraft.

[c44] 44. The apparatus of claim 39 wherein the guide path includes a first guide path portion, and wherein the movable device includes a container section movable along the first guide path portion, the movable device further including a gripper, the gripper being positioned to detach the lifting surface of the aircraft by slidably moving relative to the container section along a second guide path portion from a first position with the lifting surface attached to the aircraft to a second position with the lifting surface detached from the aircraft.

[c45] 45. The apparatus of claim 39, further comprising an elevating member coupled to the aircraft support to move the aircraft support relative to the storage apparatus.

[c46] 46. The apparatus of claim 39 wherein the storage apparatus includes a storage container.

[c47] 47. The apparatus of claim 39, further comprising the unmanned aircraft.

[c48] 48. An apparatus for handling an unmanned aircraft, comprising:
a storage container that includes a first guide structure having a first guide path, the storage container including a movable portion movable along the first guide path, the movable portion including a second guide structure having a second guide path;
a cradle movably carried by the storage container and positioned to support a fuselage of the aircraft; and
a gripper carried by the movable portion of the storage container and positioned to contact and releasably engage a lifting surface of the aircraft, the gripper being movable along the second guide path between a first position and a second position.

[c49] 49. The apparatus of claim 48 wherein the movable portion is slidable along the first guide path and the gripper is slidable along the second guide path and pivotable relative to the second guide path.

[c50] 50. The apparatus of claim 48, further comprising an elevating member releasably coupled to the cradle, and wherein the elevating member is configured to move the cradle relative to the storage apparatus.